

Application No. 10/540,365
Response to Office Action dated May 9, 2007
Paper dated September 10, 2007
Attorney Docket No. 2950-051771

REMARKS

The present invention is directed to a work-hardened stainless steel sheet characterized by its chemical composition and metallurgical structure, which can be formed to a particular configuration without cracking, even under severe fabricating conditions. The formability and strength of the stainless steel sheet is achieved by the combination of desulfuring and deoxidizing with Al for modification of inclusions to fine Al_2O_3 or $\text{Al}_2\text{O}_3\text{-MgO}$ particles sized 10 μm or less with an index of cleanliness of 0.06% or less and by cold-rolling for formation of the work-hardened ferritic structure without requiring heat-treatment.

Typically bending workability of a stainless steel sheet obtained by work-hardening is generally worsened, however, the present invention teaches a work-hardened stainless steel sheet comprising a chemical composition consisting of specifically claimed components and a specific work-hardened ferritic structure. The combination of these features improves the strength and bending workability of the work-hardened stainless steel.

Claims 4-7 are rejected under 35 U.S.C. §103(a) as being obvious over the teachings of Japanese Patent 354087629 (hereinafter referred to as “JP ‘629”). The Examiner asserts that the English abstract of JP ‘629 teaches a ferritic stainless steel alloy having a composition with constituents whose wt% ranges overlap those recited by the claims. The Examiner also asserts that JP ‘629 teaches retaining Al_2O_3 inclusions with a diameter of more than 5 μm in an area range of 0.01 wt% and alleges that this teaching would overlap the range of the present invention and therefore closely suggest the present invention’s limitation of Al_2O_3 inclusions of 10 μm or less in size distributed with an index of cleanliness of 0.06% or less. The Examiner also notes that the reference teaches the additional constituents of N and V, but N has a wt% having a lower limit of zero and the addition of V is optional.

Applicants respectfully traverse the Examiner’s rejection for the following reasons. JP ‘629 relates to a stainless steel which is used for welding construction materials for oil refining apparatuses and other various chemical apparatuses. The composition is utilized for eliminating deterioration in toughness and workability. The stainless steel of the reference is obtained by hot-rolling, not obtained by work-hardening as required by the claims of the present invention. JP ‘629 fails to disclose or even suggest that the stainless steel material may be work-hardened, let alone the specific work-hardened ferritic structure as set forth in the claims.

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Furthermore, although JP '629 discloses workability of the stainless steel, the reference fails to disclose bending workability after cold-rolling.

As to the specifically claimed chemical composition of the stainless steel sheet, JP '629 teaches that it is necessary to reduce the amount of C and N as much as possible in order to improve the toughness and workability. The stainless steel of the present invention allows for a larger amount of C than that of JP '629 by controlling the size and index of cleanliness of the work-hardened ferritic structure. Also, it should be noted that JP '629 has a significantly higher upper range limit for Al as opposed to the present invention. The specification states that excess Al causes massive precipitation of Al_2O_3 particles.

For the reasons set forth above, it is respectfully requested that the rejection of claims 4-7 under 35 U.S.C. §103(a) be withdrawn as JP '629 fails to render these claims obvious.

Claims 4-7 are also rejected under 35 U.S.C. §103(a) as being obvious over the teachings of Japanese Patent 402270942 (hereinafter referred to as "JP '942"). The Examiner asserts that the English abstract of JP '629 teaches a ferritic stainless steel alloy having a composition with constituents whose wt% ranges overlap those recited by the claims of the present invention. The Examiner also asserts that the English language abstract of JP '942 teaches a stainless steel having high-purity and high-cleanliness, whereby the total sum of oxide-type inclusions and sulfide-type inclusions is regulated to no more than 0.02% and is within the present invention's index of cleanliness of 0.06% or less. The Examiner alleges that even though oxide inclusion of 10 μm or less as recited by the claims is not taught, such would be expected since the composition and index of cleanliness are closely met, and in absence of proof to the contrary. In regard to the composition taught by JP '942, the Examiner acknowledges that JP '942 teaches the addition of N in an amount of 0.005-0.2%. However, the Examiner further alleges that the presence of 0.005% N would be equivalent to "at an inevitable impurity level and therefore not excluded from the claimed 'consisting of' limitation" of the claims.

Applicants respectfully traverse the Examiner's rejection for the following reasons. JP '942 is directed to a high-purity and high-cleanliness stainless steel which is excellent in crevice corrosion resistance and rust resistance. The stainless steel of the reference may have a chemical composition with certain components which overlap that of the present invention, however, the reference fails to teach the chemical composition and size of the work-

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hardened ferritic structure as recited in the claims. In the stainless steel composition of JP '942, it is necessary to reduce the amount of S and O as much as possible and to add Ti and Al in order to improve the workability. Note that JP '942 teaches an Al content of up to 0.2 wt% as opposed to that of the present invention of up to 0.05 wt%. Thus, JP '942 teaches the need for significantly greater amounts of Ti and Al than the present invention in order to improve the workability of the stainless steel. Accordingly, in the present invention, the cost for reducing the amount of S and O (that is, high purification) can be decreased, compared to JP '942.

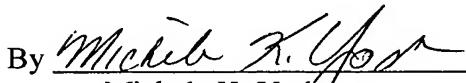
For the reasons set forth above, it is respectfully requested that the rejection of claims 4-7 under 35 U.S.C. §103(a) be withdrawn as JP '942 fails to render these claims obvious.

Conclusion

Based on the foregoing remarks, reconsideration of the rejections and allowance of claims 4-7 are requested.

Respectfully submitted,

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